

JAN-FEB

## LIST

1987

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## Minutes of the December 14, 1986 LIST meeting

The meeting commenced at 2:30 PM. Eighteen members were in attendance.

## Old Business:

Updated QL purchase information was presented by Nazir Plashtoon. Nazir stated that those members who had provided him with their names and addresses for a QL purchase would receive documentation from Doug Dewey shortly. Nazir stated that A+ does accept plastic and it probably be in the purchasers best interest to make payment with either a Visa or Mastercard in the event that if a problem with your shipment arises, You have a margin of control over the situation. A sur-charge of 4% will be added to the purchase cost, however, well worth it.

The club tape price schedule was reviewed and will remain as stated in the previous issue of LIST with the exception for members attending the monthly meetings. The cost for the current tape (6.0) for attending members will now be \$1.50. We hope this will attract more members to attend meetings.

A club tape will be offered free of charge to all new members. Please do not mistake this offer for a free club tape when you renew your annual LIST membership. New members only.

RENEW YOUR SUBSCRIPTION

Bob Malloy was nominated and unanimously voted in as the LIST Treasurer. Good Luck Bob.

Another nomination was placed, voted on and accepted for H. Rait, our club tape librarian to purchase a Sears Dubbing Deck to produce the LIST software. The cost is in the range of \$60.00. The dubbing deck will be available to the membership at all future meetings for the purchase of LIST software.

#### New Business:

Nominations for club officers for 1987 are scheduled at the January 11, 1987 meeting. Please plan on attending this important event.

Stoney McM was contacted by the Cleveland Timex User Group with reference to a club tape exchange. H. Rait's address will be forwarded to them to make the necessary exchange arrangements.

Paul D. distributed copies of "The Guide To T/S Telecommunications" by T/S USERS. There were not enough copies to go around and we hope Paul can provide additional copies for those members who would like copies.

Newsletter exchanges with other user groups was discussed. We must receive newsletters from other groups on a one-for-one basis or we may have to cancel our exchange agreement.

S.Kay requested current product information from T/S software/hardware vendors be made available to club members.

Patrick F. volunteered to type material for the LIST newsletter on an IBM typewriter.

Stoney McM. discussed the New Jersey Computer Show. He demonstrated a QL graphics program on his QL and \$55.00 monitor. Stoney then conducted a one hour seminar on QL Program Control. This was quite a professional performance on Stoney's part. It is hoped that he will continue these QL seminars at future meetings for those of us who plan on purchasing a QL in the near future.

Some TS 1000 & 2068 software was available for sale by some members at the end of the meeting.

Bob M. sold Club Tape 6.0 to members in attendance.

## **Announcement**

### **Mid West T/S Computer Fest.**

The time and location of the T/S Computer Fest is finalized. The show will take place in Indianapolis, Indiana, the weekend of May 3-4. Single registration before 3-1-87 is \$4.00. After that date single registration will be \$6.00. For booth/table information contact

Paul Holmgren  
Exec. Director  
5231 Wilton Wood Court  
Indianapolis, Ind. 46254



## QL Computer "Kit" Notes

By : N.A.Pashtoon and Paul Donnelly

In the paragraphs to follow we thought we will share our experience of the QL Kit with LIST readers. To begin, the use of the word "kit" is misleading, because all you need is a Philips screw driver and may be a long nose plier to finish the assembly. In our case the assembly job was done by a high school junior and a college freshman, PJ and FP. Both have little or no experience building electronic kits. On the other hand both are proficient with computers, especially the T/S line. For that matter they have been the game experts for the LIST Group. The assembly was finished by both in approximately two hours.

The assembly instructions provided by A+ are of good enough quality, that inexperienced users can follow them. Here are some observations on some confusing aspects of the assembly: Step1: You must exercise care and push in the RESET switch while placing the circuit board in the bottom half of the computer case.

2. The kit manual mentions three brass screws as part of the kit. There is only one such machine screw used for holding the voltage regulator to its post. (One user reports that even that one screw was not made of brass in his kit).

Step 3. Be very careful with the microdrive cables and make sure that the pins are straight. (El Cheapo design!!!). Further the pinch roller in the microdrives has a tendency to misplace itself upwards after a few months use, rendering the microdrives nonfunctional. A tiny droplet of Crazy Glue (per Doug Dewy's instructions) cures the problem.

Step 4. In order to install the heat sink, you have to bend upwards the regulator on the microdrive. We also noticed that the heat sink contour snugly fits a large electrolytic capacitor on the main circuit board. We don't believe that electrolytic capacitors last long when heated continuously. A small piece of teflon spaghetti used as a spacer between the cap. and the heat sink cures the problem.

Step 5. When installing the regulator on the heat sink, you must use a generous amount of Z5 heat sink compound. By generous we mean spread a thin film of the Z5 on the regulator tab as well as as the heat sink surface facing this tab. The QL over heating problem is well known. The Z5 compound can be obtained from Radio Shack.

Even with the above precautions one of the computers started crashing after an hour use, and could not be RESET. This problem was cured by installing a 0.1 microfarad ceramic capacitor ( 50 v. rating) on the the voltage regulator pins ( From the center pin to the other two pins). This cure has been suggested by Tom Bent in Quantum Levels. The computer was then used continuously for seven hours, without any problems. (Will Sinclair Research ever learn how to design proper power supplies!!!!).

## QL Failure Modes. By: NAP

The following info. concerning possible failure modes of QL computers was gathered after talking with experienced users and QL dealers. The QL uses some custom CMOS chips which are static sensitive, and can be destroyed easily. Consider the following scenarios:

1. A software is protected by Lens Lock, you touch the CRT screen, and then touch the key board, zap goes the computer. Note that if you walk on carpets, and then touch the keybd. the static build up on your body can destroy the QL.

2. While the computer is on, you decided to disconnect one monitor ( say a B&W) and then connected another monitor (say color) which is on, the computer ends up in silicon heaven.

3. Printer connection and disconnection when the computer and printer is on, could be a problem. We know of another computer which got zapped under these circumstances, the repair came to 3.5 Intergalactic Credit Units (i.e. 3.5 QL's).

4. You bought this expensive board ( say a disk interface), every thing is off, you connect all the cables properly, and then turn on the system. Smoke comes out of the QL. The reason: Some of these boards have the the power traces on the peripheral board running on the edge of the board. The American QL has foil covering the inside surface of the case in the vicinity of the expansion bus connector. The foil is grounded. The foil touching the power trace caused the disaster. Cure : Give a thorough visual check to all peripheral boards. Any traces on the edge of the board, which may be shorted by the foil must be covered by electrical tape.

5. The microdrives storage on the QL is definitely more unreliable compared to TS2068/Spectrum +I/F-1 combination. In just one month use 4 cartridges got corrupted, as compared to corrupting 4 cartridges on the TS2068 in two years. The moral is prepare backups immediately after receipt of any software.

# Resources and Products for the QL

By: N.A. Pashtoon

The last two months I called up various vendors and asked for their catalogs of QL products. The information supplied by these vendors is tabulated and categorized in the tables presented below. The information from two vendors is missing from these tables. The vendors are Brice Road Pharmacy, and Curry Computer. Brice Road Pharmacy came to my attention too late and I did not ask for their product catalog. Curry Computer, even though I asked for their catalog, I have not the information yet. I think they mailed the info. to my previous address. I talked with SUNSET Electronics. John Woburn told me that yes he had QL products, but that he was getting out, and no he is not selling his existing stock at "fire-sale" prices. He did not send me his brochure. Zebra Systems is out of the QL market and sold their existing stock at below cost to another vendor. We did not list the A+ Computer prices for some of the products that they carry. Since you already had their brochures and their was a very low price in effect for LIST members, I assumed that you have already taken advantage of the opportunity.

The prices in the tables is based on the vendor brochures supplied to me mostly before X-mas. As such some of the prices may be only X-mas specials. In other words it is a good idea to check with the vendors first. The price tabulations shown are just for reference, and they were prepared by rounding up the prices shown in the vendor brochures. Don't forget that these prices are not the last word. By this I mean, suppose that you were planning to buy three or four items for your computer, you can call any of the listed vendors, and probably work out a special deal. If you are in the market for purchasing disk drives for your computer, I suggest that you exercise caution. The prices advertised by QL vendors may not be the lowest. To give you an example the Amdek 3", cased dual drives with power supply is advertised by some TIMEX vendors for a price of close to \$250.00. The same exact product is available for \$75.00 from

Peripherals Direct Ltd.  
P.O. Box 4301  
Northbrook, Ill. 60065  
312-498-9244

If you are concerned about the availability of the 3" diskettes, there is no reason to worry. Any of your local SEARS stores can supply the diskettes.

Finally, the tabulation under books for the QL, I have listed the titles and prices from Quantum Computing. All the other vendors carry some of these titles, and some times at lower prices, than Quantum Computing. I visited Quantum Computing and spent a few hours with Frank Toumey, the owner. He is knowledgeable, TS enthusiast, and a professional programmer. I was surprised to find a powered up TS1500 in his basement, as well as a TS2068. Any how, I discovered that even though his brochures advertise all these titles for the QL, he actually had only six or seven titles in stock. The moral is, before ordering, make sure that the vendor has the item you need in stock. If the item is not in stock, it will probably take a couple of months for the vendor to get it from England. Don't forget, that you can also order any of the QL stuff directly from England, using plastic, probably faster and even save some money in the process. I do like to apologize in advance if there are any transcription errors in the tables.

**STOP PRESSES.....STOP PRESSES...**

*By far the BEST BUY I have ever seen in 66 TPI DSDD half height disk drives made by a venerable company like Philips, is a price of \$50.00 for one, and \$90.00 for two.*

*E² COMPUTER PRODUCTS / 2273 American Ave./ Hayward, CA 94545 / 415- 786-9203*

*The track to track access time was quoted on the phone as three mS (Wow!), and they said these are brand new and under warranty. When I receive the units I will report on them.*

**TS2068/Spectrum:** It is reliably reported that the new discipule Interface works reliably with a TS2068 equipped with a twistor. The discipule interface looks exactly like Interfacel, but it is a disk interface. It has the NMI save switch as well as Kempston compatible joystick I/F. It also has a Centronics parallel printer I/F, as well as networking capability. The best is the price, which is 73.00 Pounds Sterling.

**To Make a Point:** You may have noticed, that starting with this issue of LIST we wanted to change the look of our newsletter. Many of the pages were prepared on a laser printer. But alas, our printing service stinks. Thus for example after we got delivery of the newsletter, we discovered that page 4 and 3 were printed upside down relative to each other. So we made another run of these pages ourselves. You can see the difference in print quality. In another words we tried but....

## QL Publications

### A) Quantum Levels

Quantum Levels is the only QL specific U.S. Based publication. Member Tom Bent is the editor. I had a chance to talk with him on the phone a few times. He was very pleasant, knowledgeable, and helpful. He sent me the first two issues of Quantum Levels as samples. The bi-monthly publication caters to the need of both beginners as well as advanced users. Since up to now three issues are out, I would urge you to subscribe from vol. 1, no. 1 ( Aug. 1986) issue. Subscription is \$18.95 a year. The address is

Quantum Levels  
P.O. Box 64  
Jefferson, N.H. 03583

### B) QL World

QL World is the only British magazine specifically dedicated to the QL. It seems not to be plagued (yet!) with all the juvenile nonsense that other Sinclair related British magazines. The articles are generally informative and do cater to the needs of beginners, advanced programmers, as well as hardware types. The yearly subscription can be arranged in the \$30 to \$40 range by any of the dealers. I am mentioning this, because if you deal directly with QL World you might be short say around \$60. ( By the way why I do I get the distinct feeling that most of the British suppliers think of North Americans as suckers? Why do they always have much higher rates for North America???)

## Monitors

### A) Best Buy

The Best Buy in monitors ( if you can find it in your local area) is the TAXAN B210 RGB ( analog ) monitor. It is priced from \$160 to \$180. In my area the Child World in Selden had it. I have also seen it some places in NYC. The overscanning problem on this monitor is not serious. The colors are very nice. I have used the unit with my TS2068 for two years, and I am very happy with it. Note that the Monitor which was sold by Sinclair was also manufactured by TAXAN. Don't forget that this is an analog RGB monitor. To make it compatible with the TTL RGB from your computer, all you need is three 390 Ohms resistors (1/8 watts will do), which you will insert in series with the R, G, and B lines coming out of your computer. I installed these resistors inside the DIN connector. If you don't install the resistors you will be over driving the monitor which may not be good for its long term health.

### B) Commodore 1902

The 1902 except for the front bezel which is different, is exactly the same monitor as the Magnavox unit so highly touted by some QL vendors. It does have some extra features like comb filter, and extra inputs. The list price is \$20 higher than the Magnavox. Before you buy it though, take your computer to any of the dealers. Make sure that you are happy with the display. Since this monitor is widely available I am sure you will be able to get some good prices on it.

### C) High priced monitors

I had a chance to test the QL with some expensive monitors such as the NEC Multisynch, Princeton Graphics HX12, and the Commodore Monitor accompany-



ing the Amiga Computer. It is hard to convey the high quality, very distinct image on these wide bandwidth monitors. The NEC Multisynch did not even require any adjustments. There was just no over scanning.

## Services

### A) Repairs

In warranty repairs are provided by A+ Computers. Out of warranty repairs are also provided. You better call them up and talk with their Technical Person. He is available for consultation weekdays from 3:00 to 5:00 p.m.(EST). The experience of LIST members show that the people at A+ are very courteous. I don't see users having any problem dealing with them. Your other source of repairs is sending your computer to England. You can find the addresses in any issue of QL World.

### B) BASIC Program Transfers

If you need to transfer your long BASIC programs from your TS2068/Spectrum to QL, and you hate to type, send a copy of the tape to our member Gene, and he will perform the service for you for a nominal fee.

Eugene Pererva  
358 Railroad Ave.  
Bridgeport, CT 06604

## User Groups

### A) QUANTA

QUANTA is the newsletter of the Independent QL Users Group (IQLUG) published in Britain for the last three years. The format of the newsletter is as letters to the editor. A typical issue has more than 30 pages of some excellent material. More importantly the group has built up a gigantic public domain library (>6 MBytes), which can probably answer the needs of most any user. The Library representative in the U.S. is member Tom Bent. For membership and other info

Brian Pain  
24 Oxford Street  
Stony Stratford  
Milton Keynes  
United Kingdom MK11 1JU

Note that they accept plastic for membership (Phone 0908-564271).

### B) North American User Groups

A network of the 35-40 User Groups in North America are supporting the T/S line of computers. Many of these have newsletters, which publish material provided by any of their members. For example here at LIST we would like to support the QL starting with this issue. At this point in time more than 30% of our members own a QL. As the learning curve of our members goes up we will be providing both software and hardware support. For the last few months we have noticed that ZXAppeal (Vancouver Sinclair Users Group) have published some nice stuff about QL. This is a very good newsletter, which seems to be leapfrogging from ZX81 to QL. The last few issues of RAMPTOP has also carried a column about QL. SINC\_LINC, a Toronto TIMEX-Sinclair Users Club publication is another good quality newsletter which has carried material on the QL in the past. It is worth mentioning that SINC\_LINC is the only newsletter which provides regular coverage on the Larken Disk Interface for the ZX81 and the TS2068/Spectrum.



## Languages / Compilers / Assemblers &amp; OS

|                    | A     | B     | C    | D     | E    | F    | G     | H     |
|--------------------|-------|-------|------|-------|------|------|-------|-------|
| 68K/OS             |       |       |      |       |      |      |       | \$150 |
| QL-Assembler       |       |       | \$33 |       |      | \$30 | \$46  |       |
| Metacomco's Assem. |       | \$46  |      | \$40  | \$46 |      | \$150 | \$50  |
| " Lattice C        | \$95  | \$100 |      | \$110 |      |      | \$120 | \$130 |
| CST C              |       |       |      |       |      |      | \$90  |       |
| Metacomco's LISP   | \$67  | \$70  |      | \$70  | \$80 |      |       | \$80  |
| " Pascal           | Call  | \$80  |      | \$85  | \$86 |      | \$90  | \$100 |
| " BCPL             | \$67  | \$70  |      | \$70  | \$80 | \$76 | \$80  |       |
| Forth-83           |       |       |      |       |      |      | \$45  |       |
| Super Forth        | \$42  |       |      |       |      |      |       | \$45  |
| Prospero Pascal    | \$100 |       |      |       |      |      |       |       |
| Prospero Fortran   |       |       |      |       |      |      |       |       |
| F-77               | \$100 | \$    |      |       |      |      |       |       |
| APL                |       | \$100 |      | \$110 |      |      | \$150 |       |
| Supercharge(Basic) | \$67  | \$70  |      | \$70  | \$90 |      | \$90  | \$80  |
| Turbo (Basic)      | Call  | \$90  |      |       |      |      |       |       |
| Q-Liberator(Basic) |       | \$80  |      |       |      |      |       |       |

## Utilities

|                   | A    | B    | C    | D    | E    | F    | G    | H    |
|-------------------|------|------|------|------|------|------|------|------|
| CLONEY            | \$9  |      |      |      |      |      |      |      |
| Copy Cartg.       |      |      |      | \$25 |      |      |      | \$35 |
| Copymate          |      | \$25 |      |      |      |      |      |      |
| QL Monitor        | \$32 | \$28 |      | \$20 | \$26 | \$21 | \$30 |      |
| QL Supermon.      |      |      |      |      |      |      |      |      |
| Disass.           | \$30 |      |      |      |      |      |      |      |
| Assembler W-bnch  |      |      | \$40 | \$35 | \$39 |      |      |      |
| The Editor        |      | \$33 |      |      |      |      |      |      |
| Screen Dump       |      |      |      | \$10 |      |      |      |      |
| TasCopy QL        |      |      |      |      |      |      | \$20 |      |
| Supertool Kit II  |      | \$55 |      | \$50 | \$53 |      | \$55 | \$55 |
| Nucleon Toolkit   |      | \$35 |      | \$33 | \$40 |      |      | \$40 |
| WD Utilities      |      |      | \$17 | \$15 |      |      |      |      |
| QL Toolkit        |      |      | \$22 |      |      |      |      |      |
| I.C.E.            |      | \$30 |      | \$32 | \$40 |      | \$40 | \$40 |
| I.C.E. Choice     |      | \$23 |      | \$22 |      |      | \$22 | \$25 |
| I.C.E. Art        |      | \$18 |      |      |      |      | \$20 |      |
| I.C.E. Toolkit    |      | \$18 |      | \$17 |      |      | \$16 |      |
| I.C.E. Compandium |      |      |      |      |      |      | \$86 |      |
| Taskmaster        |      | \$40 |      |      |      |      |      |      |
| QL Switch         |      |      |      |      | \$22 |      |      |      |
| QFlash            |      | \$26 |      | Call |      |      |      |      |
| JOSS              |      | \$26 | \$28 | \$25 |      |      |      |      |
| Cartridge Doctor  |      | \$23 | \$22 | \$20 | \$22 |      | \$22 |      |
| Terminal Emulator |      |      | \$28 |      | \$24 |      | \$30 | \$30 |
| RAM Disk          |      |      |      |      | \$17 |      | \$20 | \$20 |
| Key Define        |      |      |      |      |      |      | \$16 |      |
| PC Import         |      |      |      |      | \$30 | \$40 |      |      |

|                    | A    | B    | C     | D      | E    | F    | G     | H    |
|--------------------|------|------|-------|--------|------|------|-------|------|
| TAX-I-QL(1986)     |      | \$13 |       |        |      |      |       |      |
| QL Entrepr.        | \$46 | \$40 |       | \$30   | \$35 | \$28 | \$40  | \$41 |
| QL Project Plan.   | \$46 | \$40 | \$33  | \$30   | \$35 | \$28 | \$40  | \$41 |
| QL Decisiom Mak.   | \$46 |      |       | \$30   | \$35 |      | \$40  | \$41 |
| LQ Recon           | \$25 |      |       |        |      |      |       |      |
| QSpell             | \$27 | \$32 | \$33  | \$27   | \$33 |      |       | \$30 |
| QL Appt. Diary     | \$30 |      |       | \$23   | \$25 |      | \$40  |      |
| Front Page         |      | \$30 |       | \$Call |      |      | \$35  |      |
| Quill v 2.3        |      | \$10 |       |        |      |      |       |      |
| Abacus v 2.3       |      | \$10 |       |        |      |      |       |      |
| Easel v 2.3        |      | \$10 |       |        |      |      |       |      |
| Archive v 2.3      |      | \$10 |       |        |      |      |       |      |
| Q-Calculator       |      | \$16 |       |        |      |      | \$16  |      |
| Archiver           |      | \$26 |       |        | \$30 |      | \$30  |      |
| Integ. Bus. Acnts. |      |      | \$150 |        |      |      | \$140 |      |
| Mail Merge         |      | \$23 | \$25  | \$22   |      |      |       |      |
| Sign Designer      |      |      |       | \$27   |      |      |       | \$30 |
| Mailing List       |      |      |       |        | \$25 |      | \$25  |      |
| Stock Control      |      |      |       |        |      |      |       | \$30 |
| Tasprint QL        |      |      |       |        |      |      |       | \$30 |
| Organiser          |      |      |       |        |      |      |       | \$30 |

## Home and Self-improvement

|                    | A    | B | C    | D    | E    | F | G    | H    |
|--------------------|------|---|------|------|------|---|------|------|
| Qmonix Keyboard    |      |   |      |      |      |   |      |      |
| Drill Sargent      | \$25 |   |      |      |      |   |      |      |
| Touch 'N' Go       |      |   |      |      |      |   |      |      |
| Typing Tutor       | \$33 |   |      |      | \$25 |   | \$30 | \$25 |
| Morse Code Tutor   |      |   |      | \$15 | \$17 |   |      |      |
| QL Gardener        |      |   |      | \$20 | \$25 |   | \$40 | \$25 |
| COSMOS (id. stars) |      |   | \$23 | \$21 | \$25 |   | \$22 | \$25 |
| QL Home Finance    | \$35 |   |      |      | \$25 |   | \$30 | \$25 |
| QL Kitchen Aid     | \$30 |   |      |      |      |   |      |      |

## CAD and Graphics

|                   | A    | B     | C    | D    | E    | F | G    | H    |
|-------------------|------|-------|------|------|------|---|------|------|
| Design Board II   | \$45 |       |      |      | \$50 |   |      |      |
| Super Sprite Gen. | \$24 | \$30  |      | \$25 |      |   |      |      |
| TechniQL          |      | \$60  | \$70 | \$63 | \$70 |   | \$70 |      |
| QL Paint          |      | \$35  |      |      | \$40 |   | \$40 |      |
| Peintre           |      | \$34  | \$35 | \$29 | \$35 |   |      | \$35 |
| Concept 3D        |      | \$35  | \$40 | \$37 |      |   | \$38 | \$40 |
| Giga Paint        |      |       | \$50 |      | \$50 |   |      |      |
| GraphiQL          |      |       | \$45 | \$41 |      |   |      |      |
| Electro CAD       |      |       |      |      | \$70 |   |      |      |
| Q Draw            |      |       |      |      |      |   |      | \$22 |
| Paint Master      |      |       |      |      |      |   |      |      |
| PCB Designer 1    |      | \$150 |      |      |      |   |      |      |
| PCB Designer 2    |      | \$150 |      |      |      |   |      |      |

## Games

|                            | A    | B    | C    | D    | E    | F    | G    | H    |
|----------------------------|------|------|------|------|------|------|------|------|
| Backgammon                 | \$20 |      |      |      |      |      | \$20 |      |
| Arcadia                    | \$15 |      |      |      |      |      |      |      |
| QL Caverns                 | \$20 | \$19 |      | \$25 | \$12 |      | \$20 | \$20 |
| QL Chess                   | \$30 | \$28 |      | \$28 | \$30 |      | \$25 | \$25 |
| Dragon Hold                | \$27 |      |      | \$28 | \$29 |      |      | \$30 |
| Matchpoint                 | \$25 | \$23 |      | \$27 |      |      | \$22 | \$22 |
| Tycoon                     | \$28 |      |      |      |      |      |      |      |
| Super Astrologer           | \$32 | \$30 |      |      |      |      | \$40 |      |
| Biorhythms                 | \$25 |      |      |      |      |      |      |      |
| QL Flight                  |      | \$28 |      |      |      |      | \$35 | \$30 |
| Droidzone                  |      | \$20 |      |      |      |      |      |      |
| Zkull                      |      | \$23 |      | \$21 |      |      | \$28 | \$25 |
| Knight Flight              |      | \$20 |      | \$20 |      |      | \$22 | \$22 |
| Karate                     | \$20 | \$18 | \$25 | \$22 |      |      |      |      |
| Area Radar Cont.           |      | \$20 |      |      | \$19 |      | \$20 |      |
| Vroom                      |      | \$25 | \$30 | \$23 |      |      |      | \$20 |
| Aquanaut                   |      | \$26 |      | \$26 |      |      |      |      |
| Citadel                    |      | \$18 |      |      |      |      |      |      |
| Lands of Havoc             |      | \$26 |      |      |      |      |      | \$35 |
| BJ The Return              | \$15 | \$19 |      |      | \$20 |      | \$19 | \$20 |
| 3-D Slime                  |      | \$19 |      | \$20 | \$19 |      | \$20 |      |
| War in the East<br>(all 3) |      | \$58 |      | \$56 |      |      |      |      |
| Wnderer                    |      | \$32 | \$40 | \$33 | \$33 |      |      | \$50 |
| Blocklands                 |      | \$20 |      |      |      |      |      |      |
| West                       |      | \$23 |      | \$21 |      |      | \$28 | \$30 |
| QL Hopper                  |      | \$23 |      |      |      |      | \$25 |      |
| Spook                      | \$15 | \$18 |      |      |      |      |      |      |
| Othello                    |      | \$25 |      |      |      |      |      |      |
| Fictionary                 |      | \$18 |      |      |      |      |      |      |
| The King                   |      | \$26 |      | \$25 |      |      |      |      |
| BJ in 3-D Land             |      | \$19 |      |      |      |      | \$20 |      |
| Squadrons                  |      | \$25 |      | \$27 |      |      |      |      |
| Mortville's Manor          |      |      |      | \$33 |      |      |      |      |
| Lost Pharaoh               |      |      |      | \$21 |      |      |      |      |
| QL Hyperdrive              |      | \$23 |      |      | \$19 |      | \$22 | \$27 |
| Exec. Trivia Qlue          |      |      |      |      |      | \$18 |      |      |
| Blast Buggy                |      |      |      |      |      |      | \$20 | \$20 |
| Bounder                    |      |      |      |      |      |      |      | \$16 |
| Zapper                     |      |      |      |      |      |      |      | \$16 |
| Bridge Player II           |      |      |      |      |      |      |      | \$30 |
| Computer Scrabble          |      |      |      |      |      |      |      | \$30 |
| Quasimodo                  |      |      |      |      |      |      |      |      |
| Star Guard                 |      |      |      |      |      |      |      |      |
| Space Paranoids            |      |      |      |      |      |      |      |      |
| QL Draw Poker              | \$15 |      |      |      |      |      |      |      |

## Hardware

|   | A     | B     | C     | D      | E     | F | G     | H     |
|---|-------|-------|-------|--------|-------|---|-------|-------|
| 256 K Mem. Exp.                         |       |       | \$180 |        |       |   | \$170 |       |
| 512 K Mem. Exp.                         | call  | \$165 | \$220 | \$165  | \$230 |   | \$220 | \$200 |
| "Q+4" Exp. Chasis                       |       |       |       |        |       |   | \$374 |       |
| QL Hard Disk                            |       |       |       |        |       |   | Call  |       |
| Memodisk(512K+Disk<br>& Centronics I/F) |       | \$280 |       |        |       |   |       |       |
| Multifcn. I/F<br>board                  | \$367 |       |       |        |       |   |       |       |
| Cumana Disk I/F                         |       | \$125 | \$155 | \$130  |       |   |       |       |
| CST Disk I/F                            | \$125 |       |       |        | \$160 |   |       |       |
| Delta Disk I/F                          |       |       | \$180 |        | \$180 |   | \$180 | \$180 |
| " " "+128K                              |       |       |       |        | \$290 |   | \$300 |       |
| Economy Disk I/F                        |       |       |       |        |       |   | \$150 | \$150 |
| Dual 3" Disk Drives                     |       |       |       |        |       |   |       | \$250 |
| 5.25" dual DSQD<br>Disk Drives          | \$277 | \$289 |       |        |       |   |       | \$289 |
| 5.25" dual DSDD<br>Disk Drives          | \$225 |       | \$289 |        |       |   | \$289 |       |
| Dual 3.5" "                             |       |       | \$379 |        |       |   | \$369 |       |
| QL Eprom Burner                         |       |       |       |        |       |   | \$170 |       |
| Centronica Pr I/F                       | \$45  | \$35  | \$45  | \$36   | \$50  |   | \$50  | \$40  |
| Qsound/Qprint                           |       | \$100 |       | \$Call |       |   |       |       |
| JS ROM                                  |       | \$50  |       |        |       |   | \$30  |       |
| QL ROM Cartridge                        |       |       |       |        |       |   | \$13  |       |
| Battery Time Clock                      |       | \$30  |       |        |       |   |       |       |
| Microd. cart/4-pack                     |       | \$9   | \$9   | \$10   | \$11  |   |       | \$12  |
| Cartridge Case                          | 3/\$1 |       |       |        |       |   |       |       |
| QL I.C.E. Mouse                         |       | \$130 | \$120 |        | \$119 |   | \$120 |       |
| 300/1200 Baud                           | \$160 |       |       |        |       |   |       | \$190 |
| Modaptor+Software                       | \$46  | \$50  | \$50  | \$50   | \$50  |   | \$50  | \$45  |
| Package of above two                    | \$190 |       |       |        |       |   |       |       |
| 300 Baud Modem                          |       |       |       |        | \$60  |   |       | \$60  |
| 300 " " with adaptor<br>+ software      |       |       |       |        |       |   | \$100 | \$100 |
| 1200 Baud Smart Mod.                    |       |       |       |        | \$160 |   |       | \$150 |
| " " " "                                 |       |       |       |        |       |   |       |       |
| with adap. & software                   |       |       |       |        |       |   | \$290 |       |

## Vendor Addresses

## A

QUANTUM COMPUTING  
P.O. BOX 1280  
DOVER, N.J. 07801  
201 -328-8840

## B

Sharp's Inc.  
Rt. 10, Box 459  
Mechanicsville, Va. 23111  
804 -746-1664 (9:00 am-4:30pm)  
804 -730-9697 (5:00pm-11:00pm EST)  
Visa & MC accepted

## C

Variety Sales  
325 West Jersey St.(2-D)  
Elizabeth, N.J. 07202  
201 -289-5699

## G

Midwest Micro-Computer Co.  
7039 Magnolia Drive  
Jenison, Mi. 49428  
616 -669-3239 (7pm -10pm EST)

## D

C.W. Associates  
419 N. Johnson Street  
Ada, Ohio 45810  
419 -634-4874

## H

Knighed Computers  
707 Highland Street  
Fulton, N.Y. 13069  
315 -593-8219 (inquiries)  
1-800-325-7497 (orders)  
Visa & MC accepted

## E

Russell Electronics  
RD 1, Box 539  
Centre Hall, Pa. 16828  
814 -364-1325 (1pm -6pm EDT)  
plastic accepted

## F

RMG Enterprises  
1419 1/2 7th. Street  
Oregon City, OR 97045  
503 -655-7484



## BOOKS

| Title  | List Price | Disc. Price |
|--|------------|-------------|
| Super Basic Definitive Handbook              | 19.95      | 9.95        |
| QDOS Companion                               | 16.95      | 9.95/8.95   |
| QL Advanced User Guide                       | 17.95      | 9.95        |
| QL Assembly Language Programming             | 15.95      | 9.95        |
| Advanced QL Machine Language                 | 14.95      | 9.95        |
| Inside the QL (Hardware Guidebook)           | 16.95      | 9.95/8.95   |
| Artificial Intelligence on the QL            | 15.95      | 9.95/8.95   |
| Developing Applications on the QL            | 15.95      | 9.95        |
| Mathematics on the QL                        | 15.95      | 9.95/8.95   |
| Intro. to Simulation Techniques              | 14.95      | 9.95/8.95   |
| The Working QL                               | 15.95      | 9.95/8.95   |
| QL Adventures                                | 14.95      | 9.95/8.95   |
| QUILL, EASEL, ARCHIVE and ABACUS on the QL   | 14.95      | 9.95        |
| Tim Hartnell's QL Handbook                   | 12.95      | 9.95        |
| Exploring Artificial Intelligence on your QL | 14.95      | 9.95        |
| Tim Hartnell's QL Games Compendium           | 11.95      | 9.95        |
| Exploring the QL                             | 9.95       | 7.95        |
| Quantum Theory Programming Guide             | 12.95      | 9.95        |
| The QL Companion (Constructs)                | 12.95      | 9.95/8.95   |
| QL Computing (Structures)                    | 13.95      | 9.95/8.95   |
| QL SuperBASIC (Stages)                       | 12.95      | 9.95/8.95   |
| QL Gamesmaster                               | 12.95      | 9.95        |
| Illustrating SuperBASIC on the QL            | 12.95      | 9.95        |
| Practical Guide to QL Graphics and Sound     | 13.95      | 9.95        |
| Good Programming with QL SuperBASIC          | 13.95      | 9.95        |
| Word Processing with QL QUILL                | 13.95      | 9.95/8.95   |
| QL QUILL Handbook                            | 14.95      | 9.95        |
| The QUILL User's Reference Manual            | 24.95      | 14.95/9.95  |
| The ABACUS User's " " "                      | 24.95      | 14.95/9.95  |
| The ARCHIVE " " "                            | 24.95      | 14.95/9.95  |
| Word Processing with the QL                  | 11.95      | 9.95        |
| Introd. to SuperBASIC on the QL              | 11.95      | 9.95/8.95   |
| Advanced Programming on the QL               | 11.95      | 9.95/8.95   |
| Using Graphics on the QL                     | 11.95      | 9.95        |
| Database Management on the QL                | 11.95      | 9.95/8.95   |
| Desktop Computing with the QL                | 11.95      | 9.95/8.95   |
| Profiting from the QL                        | 11.95      | 9.95        |
| Making the Most of the QL                    | 11.95      | 9.95/8.95   |
| Machine Code Programming on the QL           | 11.95      | 9.95/8.95   |
| QL Technical Guide (QDOS Reference Manual)   | 39.95      | 29.95/25.95 |
| QL Service Manual (by EMI)                   | 25.95      | 19.95       |

Note: The lowest price indicated after the discounted price is from a recent brochure (effective Jan. 15) from Sharp's.

## Comments on Dr. Watson's Bankswitching Article

By : N.A. Pashtoon

In the previous issues of LIST you have seen the contributions of Bill Pedersen concerning Bankswitching on the TS2068. I had a long phone conversation with Bill, and asked him to provide LIST with a comprehensive culminating article to the series. Let us hope that he finds the time, and writes an article which will integrate the concepts he presented, as well as tie all the loose ends in his proposed approach to the design of the Bank Expansion Unit (BEU).

In the last three issues of TIME DESIGN Magazine, Wes Brzozowski published an intriguing series of articles titled "The Mystery of the Missing 253...". Wes has done an excellent detective work on the code of the TS2068 to unravel the mysteries of the hardware architecture of the BEU.

Recently we at LIST were lucky enough to receive a long article from Dr. Watson(?) concerning the intentions of the design team of the T/S 2000 series computers. We here at LIST realize that some of the information in Dr. Watson's article was superceded at the time when the TS2068 was released. We still think that information is still relevant, i.e. it is not a nostalgic look backwards for what might have been if..... The information is especially relevant as far as the the System Configuration Table (SCT or SYSCON), and in explaining the code of the ID block in any of the expansion banks is concerned. The article also sheds light on channels and streams, and the buildup of RAM tables for dumb and intelligent devices.

The article as we received it was too long to be presented in a single issue of LIST. So we split it in two parts. The second part will be published either in the March '87 or April '87 issue of LIST. The second part of the article will explain the function dispatcher, and all the missing and reserved codes which appeared in the TS2068 Tech. Manual. As such, the article is an excellent addition to your Tech. Manual.

It is noted that in Wes' articles in TIME DESIGNS, there were question marks and misinterpretation of SCT entries. Dr. Watson ( in a small note accompanying the manuscript) expressed the hope that the article will fill the gaps, and correct the errors.

The envelope in which the article arrived, did not have a return address. Considering that Dr. Watson is 145 years young, it is no wonder. In the small note accompanying the article Dr. Watson explains that information was relayed to him by Inspector Hither-ton of The Scotland Yard. It seems that The Scotland Yard and Mr. Holmes were cooperating on a case known as " 'Now you see it, Now You Don't' Computer Division of TIVIX\_Ltd.". For that matter at the time of information relay to Dr. Watson, Mr. Holmes was on an overseas sojourn, somewhere in the Iberian Peninsula, investigating certain anomalous investment patterns by the said company.

In order for our general readership to benefit maximally from Dr. Watson's contribution the following reference material is suggested.

- 1). "The Case of The Missing 253..." by Wes Brzozowski, in the last three issues of TIME DESIGN Magazine.
- 2) TS2068 Tech. Manual.
- 3) " Bankswitching the 2068", by Ray Kingsley in the Jan.-Feb. '85 Syncware News.
- 4) For the Function Dispatcher ( to be published) you will need " A Comparative ROM Atlas- From Spectrum to TS2068" by N.A. Pashtoon, in the Nov. 1984 issue of SYNTAX. The same tables were also published in LIST: Jan. '85 to Apr. '85.

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**THANKS** to Doug Dewey who cheerfully accepted the task of becoming the "User Group Dealer" for benefit of LIST and CATS. Doug is the kind of person that on other numerous occasions has come through for us in ways I can't recount here. So all LIST members who purchased your QL's through Doug, kindly send him the \$10 he requested for his service. Think of all the long distance calls and writing letters and processing checks, not to mention the time.

# Bankswitching, etc. on the T/S 2000 Series Computers

## Part I

By : Dr. Watson

### 1 BANK SWITCHING

Since the T/S 2000 is a Z-80 based computer and can only address 64K of memory directly, a bank selection mechanism is provided. Memory is selected in 8K "Chunks" which are identified by bank number (horizontal index) and Chunk number (vertical index), as illustrated by Figure 1.

The Home Bank is the bank which is selected by default, other banks must be explicitly selected. All banks are identified by a number, 0 - 255. Bank 0 is an AROS and/or LROS (i.e. DOCK Bank), banks 1 through 253 are peripherals, bank 254 is the Home ROM Extension, (i.e. EXROM Bank) and bank 255 is the Home Bank. Bank selection services are provided by the system software (refer to Section 12). The following paragraphs will describe the architecture of the banks in the system.

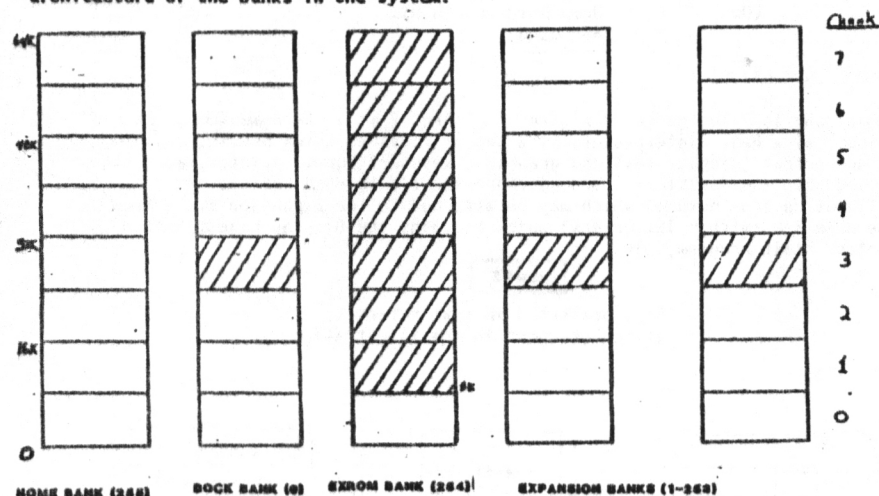


Figure 1 . SYSTEM MEMORY ARCHITECTURE

The memory space on the TS 2000 consists of a 64K Home Bank, a 64K DOCK Bank, an 8K EXROM Bank and a plurality of 64K Expansion Banks. The memory map is shown in Figure 1. Each 64K bank is divided into eight 8K "Chunks". The T/S 2000 hardware provides an ability to enable eight Chunks under software control which determine the actual 64K address space of the Z80 at any one time. At most one Chunk along the horizontal axis may be enabled at any one time (i.e., if Chunk #1 is enabled in the DOCK Bank, it must/will be disabled in all other banks). Details of the software control of bank switching are contained in paragraph 12.

### NOTE

The Home Bank has the lowest priority, thus its Chunks are enabled by default when no other bank has the same Chunks enabled. The DOCK Bank has the next highest priority, thus its Chunks are enabled when no expansion Bank has the same Chunks enabled. The expansion Banks have the highest priority. The Home ROM Extension Bank (EXROM) has the same priority as the DOCK Bank.

### 2. Reserved Chunks

Note that the machine stack, function dispatcher and bank switching communication facilities must always be available to the system. These routines will always be in either Chunk 3 or Chunk 7 of the Home Bank. One of these Chunks must always be enabled. The one that must be enabled is the one that contains the code listed above.

A system variable called VIDMOD (location 23741) determines where these blocks of code are at any given time. If VIDMOD is zero, then they are in Chunk 3. If VIDMOD is non-zero, then they are in Chunk 7. These routines are moved up to Chunk 7 if the secondary display file (D\_FILE\_2) is requested for use.

If you are operating a 16K machine, then these routines will always be in Chunk 3 because there is no memory to hold them in Chunk 7.

Whichever Chunk or Chunks are utilized to hold these essential routines, it/they should always be enabled within the Home Bank (i.e. disabled in the DOCK Bank and all Expansion Banks). Thus, Chunk 3 (and/or 7 if the second display file is used) should not be enabled in any bank other than the Home Bank.

### 3. BANK SWITCHING CONTROL

The bank switching communication services access the bank switching hardware by reading and writing to the following I/O ports:

- . DKHSPT = F4H: DOCK horizontal select port
- . BDATPT = FCH: Expansion Bank "data" port
- . BCHOPT = FDH: Expansion Bank "address" port
- . HREXPT = FFH: Home ROM Extension select port (bit 7)

These ports read from and/or write to the following bank switching hardware registers:

- . DKHSPT writes to: DOCK horizontal select register
- . BDATPT writes to: Registers 0-3
- . BCHOPT writes to: Address register (selects registers 0-3)

3

In addition there are the following registers:

- HOLD : Temporary holding register
- ABN : Assigned bank number register (one for each Expansion Bank)
- BNA : Bank number accessed register
- HS : Expansion Bank horizontal select register (one for each Expansion Bank)
- STATUS : Status nybble whose bits have the following interpretation:
  - bit 0 - Set to 0 if bank caused an interrupt (maskable) -
  - bit 1 - Not used
  - bit 2 - Set to 0 if bank is responding to memory read/write
  - bit 3 - Not used

The bank switching controller chip uses a four-bit data path (D0-D3).

The DOCK horizontal select register specifies which of the DOCK Bank Chunks are enabled (active high). The hold register is used to latch data in and out of the ABN, BNA, and HS registers. The BNA register contains the bank number of the bank whose status is currently being changed or queried. There is only one hold register and one BNA register. There are ABN and HS registers for each expansion Bank. The ABN register contains the bank number assigned to a particular bank. The HS register specifies which Chunks in the expansion Banks are currently enabled (active high).

The DOCK horizontal select port accesses the DOCK horizontal select register. This port is both read from and written to. The expansion Bank "address" port is used to specify which register to write to, or read from. The "data" port is used to read/write data to the designated register within the bank switching controller. The addresses are listed in Table 1

Table 1  
EXPANSION BANK CONTROLLER REGISTERS

| ADDRESS | READ DATA PORT    | WRITE DATA PORT           |
|---------|-------------------|---------------------------|
| 0       | Read status       | Write cmd ls nybble       |
| 1       | None              | Write cmd ms nybble       |
| 2       | Read HS ls nybble | Write hold reg. ls nybble |
| 3       | Read HS ms nybble | Write hold reg. ms nybble |

The two command (cmd) ports have the functions listed in Table 2.

Table 2  
CMD REGISTER FUNCTIONS

Command -- Least significant nybble

| BIT | ACTIVE | FUNCTION   |
|-----|--------|--|
| 0   | LOW    | Reset controller -- prepare for initialization         |
| 1   | LOW    | Start interrupt REG sequence.                          |
| 2   | LOW    | Initialization done. Move to next bank in daisy chain. |
| 3   | LOW    | Reset interrupt flag.                                  |

Command -- Most significant nybble

| BIT | ACTIVE | FUNCTION              |
|-----|--------|-----------------------|
| 0   | LOW    | Dump hold REG to ABN. |
| 1   | LOW    | Dump hold REG to BNA. |
| 2   | LOW    | Dump hold REG to HS.  |
| 3   | -      | Not used.             |

#### 4. HOME BANK LAYOUT

The Home Bank is illustrated by Figure 2. Area 2 is a 16K Home ROM which contains: a) a BASIC interpreter, b) a set of routines which provide basic input and output (display text and graphics, keyboard input, printer, access to the sound chip and joysticks), and c) channelled I/O to dumb devices or intelligent devices both of which may be attached to the Expansion Bus. Area 1 is the Home RAM (either 16K or 48K) which contains the Display Files, System Variables, BASIC Program, etc.

#### NOTE

Area bracketed in text refers to its counterpart in the illustration.

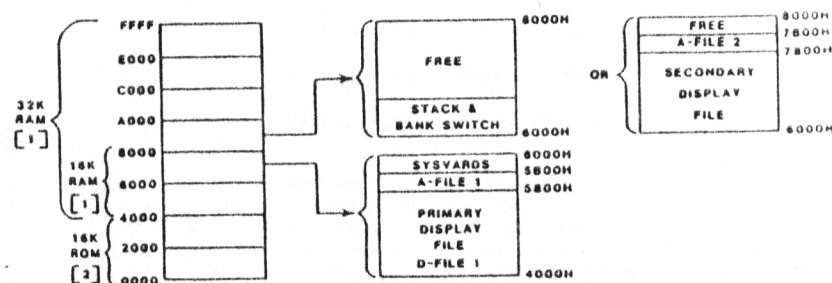


Figure 2 . HOME BANK ARCHITECTURE



## 5. EXROM BANK LAYOUT

The Home Bank has associated with it an 8K ROM. This ROM together with the 16K ROM make up 24K of System ROM. The 8K ROM is located in a separate bank called the EXROM Bank. (This 8K ROM is called the EXROM.) Contained within the ROM are: the cassette tape I/O routines, the bank switching code, and the system initialization routines.

This ROM is accessed by a software switch. Bit 7 of I/O address FFhex designates the selection status of the EXROM. If this bit is set, the EXROM will overlay the lowest 8K Chunk (Chunk 0) in the DOCK Bank.

Thus, to access this ROM, you must set bit 7 in port FFhex, and set at least bit 0 in the DHS register (I/O port F4h). You must also insure that no external banks have their first Chunk selected, as external banks have higher priority than the DOCK Bank and would override the system's access to the DOCK Bank, and thus the EXROM.

### 6.1 ROM ORIENTED SOFTWARE (ROS): AROS/LROS

A connector is present on the T/S 2000 base unit and on each Bus Expansion Unit (BEU) (refer to paragraph 8.1) to allow the plug-in of ROM Oriented Software. The ROS component may be one of two types or both:

1. Application ROM Oriented Software (AROS), and
2. Language ROM Oriented Software (LROS).

The AROS contains an application program which eliminates the cassette loading step and makes all of the system RAM available for data. The LROS allows the T/S 2000 to take on a personality other than that of the BASIC programming language (i.e.; other languages such as LOGO, etc.). The system software's architecture supports the ability of both an AROS and an LROS to be used at the same time.

It should be noted that both the AROS and the LROS share the same 56K of address space. An individual ROS may use up all or part of that 56K of space (the DOCK Bank). If LROS and AROS are to be used simultaneously, their address spaces must not overlap. Therefore, if an LROS is designed to accept an AROS, the LROS's designers must trade off maximum LROS size against desired sizes for their AROS. Typically the LROS will be a maximum of 24K and AROS will be a maximum of 32K bytes.

#### NOTE

If you plan on writing a BASIC Program for possible use in an AROS, it must not utilize user-defined functions. They are not supported in AROS's.

## 6.2 LROS

LROS will typically map into the address space between the 0000 and 5FFF (24K). If the second display file is to be used instead of the first, then the LROS may extend to 7FFF (32K). If the system initialization routine detects the presence of an LROS, a jump to the starting address (contained in 0002H) is performed, thereby passing control to the LROS. The following overhead bytes must appear in every LROS (all addresses are in hex):

- 0000 - Not used (one byte)
- 0001 - Cartridge Type (one byte)
  - 1 = LROS
- 0002 - Starting address (two bytes)
  - Address to be jumped to after operating system initialization is complete.
- 0004 - Chunk specification (one byte)
  - Bits 0 - 7 represent Chunks 0 - 7 respectively as follows:
    - 0 = if not in use
    - 1 = if in use

## 6.3 AROS

AROS will typically map into the address space between 8000 and FFFF (32K). If the second display file is to be used by the system, then the AROS will map into the address space between 8000 and DFFF (24K). If the initialization routine detects the presence of an LROS, control is passed to the LROS upon completion of the initialization as described above. The LROS is then responsible for RUNNING any installed AROS. If just an AROS is present, it is treated as a BASIC/machine language program with system RAM used for program variables. The following overhead bytes must appear in every AROS (all addresses are in hex):

- 8000 - Language type (one byte)
  - 1 = BASIC and machine language
  - 2 = Machine language only
  - 3 = LOGO
  - 4 = PASCAL
- 8001 - Cartridge type (one byte)
  - 2 = AROS
- 8002 - Starting address (two bytes) - for language type:
  - 1 = Beginning of BASIC program
  - 2 = Starting address of machine language program
  - 3 = To be determined
  - 4 = To be determined

7

8004 - Chunk specification (one byte)

Bits 0 - 7 represent Chunks 0 - 7 respectively as follows:

0 = If not in use

1 = If in use

8005 - Autostart Specification (Language type 1 or 2) (one byte)

0 = If ROS not to be autostarted

1 = If ROS is to be autostarted

8006 - Number bytes for user area (two bytes)

## 7. DOCK BANK

The architecture of the DOCK Bank is illustrated by Figure 3. Either an AROS, an LROS, or both may be present in the bank. An AROS alone could contain a BASIC and/or machine code program. BASIC code in the AROS would be interpreted by the Home ROM, but the entire program would not be loaded into the Home RAM. Machine code in an AROS would be executed in the AROS. An AROS together with an LROS could be a program in some language (such as LOGO, and possibly including some machine code) supported by the LROS. An AROS or LROS alone may be up to 56K in size, where size is measured in 8K increments. An AROS and an LROS together must not add up to more than 56K and their address spaces must not overlap.

Note the hatched Chunk in Figure 3. This indicates a Chunk which is on the same horizontal slice as the machine stack in the Home Bank. This Chunk should not be used by the DOCK Bank.

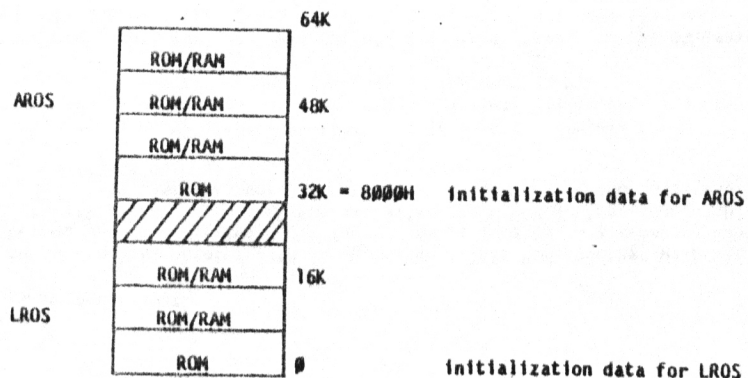


Figure 3. DOCK BANK ARCHITECTURE WITH D\_FILE\_2 OFF

8

## 8. EXPANSION BANKS AND BUS EXPANSION UNIT

Paragraph 8.1. describes Expansion Banks and the Bus Expansion Unit.

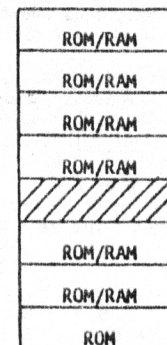


Figure 4. EXPANSION BANK ARCHITECTURE WITH D\_FILE\_2 OFF

## 8.1 Peripheral Expansion Bus

The Expansion Bus connector allows the attachment of one or more peripherals to the T/S 2000. Up to two peripherals may be attached directly to the Expansion Bus connector. If more than two peripherals are desired, a Bus Expansion Unit which contains four connectors is attached first. These connectors may be used to attach multiple peripherals. An additional Bus Expansion Unit may be attached to the first one, allowing a maximum of seven devices to be attached to the T/S 2000. Each of the devices may also contain one or more Expansion Banks. An Expansion Bank is a bank of up to 64K of RAM/ROM. The hardware and software architecture of the T/S 2000 supports up to 253 Expansion Banks. The Bus Expansion Unit is invisible to software. The BEU also contains one additional DOCK connector.

## DIGRESSION

## DHS

The horizontal select register for the DOCK Bank is accessed through I/O address F4h. It is read/write. It is called DOCK Horizontal Select. Each bit is active high. This means that if bit 3 of DHS is set high, then Chunk 3 of the DOCK Bank is mapped into the CPU's address space.

## BANK CONTROLLER I/O PORTS

The expansion Banks on the T/S 2000 each use a controller IC (integrated-circuit). This controller uses two I/O ports. They are:

- FCh - Data Port
- FDH - Address Port

The Expansion Banks are used for controlling intelligent devices or for memory expansion. They may contain ROM and/or RAM as shown in the memory maps (refer to Figures XXXXXX 1 and 3 ). Except for RAM banks, each Expansion Bank must contain the following overhead information to be properly recognized by the system software:

- 0000 - Device Specification (1 byte) (Refer to Table 3 for a list of device specifications.)
- 0001 - Address of device OPEN routine (2 bytes)
- 0003 - Address of device CLOSE routine (2 bytes)
- 0005 - Address of device SELECT routine (2 bytes)
- 0007 - Address of device INPUT routine (2 bytes)
- 0009 - Address of device OUTPUT routine (2 bytes)
- 000B - Address of disk command handler routine (2 bytes)  
(see Device Type (bit 1) below)
- 000D - Address of device Interrupt Handler routine (92 bytes)
- 000F - Address of device Initialization routine (2 bytes)  
(cold start)
- 0011 - Address of device RESET routine (2 bytes)  
(warm start)
- 0013 - Device type (1 byte)  
Bit 0 = 0 Bootable  
          1 Initializable  
Bit 1 = 0 Non-storage device  
          1 Storage device (capable of handling disk commands)
- 0014 - Device Boot Priority (1 byte)  
(0 - 255)
- 0015 - Device Interrupt priority (1 byte)  
(0 - 255)

Table 3  
DEVICE SPECIFICATIONS

| BYTE | DEVICE                    |
|------|---------------------------|
| 'T'  | Telecommunications Device |
| 'F'  | Stringy Floppy            |
| 'D'  | Floppy Disk               |
| 'H'  | Hard Disk                 |
| 'R'  | RS232 Interface           |
| 'C'  | Centronics Interface      |
| 'P'  | Printer (80-column)       |
| 'L'  | Local Area Network        |
| 'R'  | Ram Insertion             |
| 'P'  | Printer                   |
| 'K'  | Keyboard                  |
| 'S'  | Screen                    |
| 'M'  | Reserved                  |

## 9. INTERRUPT HANDLING

The following information details the processes used for handling interrupts on the T/S 2000.

Non-maskable interrupts are to be handled in the following fashion:

The occurrence of an NMI causes a return address to be pushed to the RAM location pointed to by SP and a restart to location 66H occurs. The interrupt handler (in whichever bank is selected) services the interrupt and returns. Since the state of the system includes the bank selection status of all the banks, all interrupt handlers must save and restore these statuses as part of their operation.

Maskable interrupts are to be handled in the same fashion as NMI's. There are interrupt fielders at location 38H in each bank other than the Home Bank, and an interrupt handler at location 38H in the Home Bank.

The interrupt handlers for both NMI's and INT's determine whether the interrupting device supplies its own interrupt handling. If this is the case, then control is passed to the address and bank specified for the device as specified in the System Configuration Table. Maskable and non-maskable interrupt handling is available in all banks.

When an interrupt is received, the system will poll each expansion Bank to see which bank caused the interrupt. If the interrupt was caused by an expansion Bank, the interrupt handler for that bank will be called. Please note that all banks should be queried, as, when an interrupt is received, it may have been caused by several banks simultaneously.

## 10 I/O CHANNELS

The T/S 2000 uses a system of I/O channels (or "streams") to create a structured environment under which input and output in and around the system may be performed.

LIST



## Specified Streams

| STREAM | ID NO. | CONNECTION            |
|--------|--------|-----------------------|
| HID-K  | -3     | Keyboard              |
| HID-S  | -2     | Screen                |
| HID-R  | -1     | RAM insertion         |
| COM-ST | 0      | Stream for commands   |
| INP-ST | 1      | Stream for input data |
| PR-ST  | 2      | Stream for PRINT      |
| LPR-ST | 3      | Stream for LPRINT     |

Streams whose ID numbers are less than zero, are referred to as hidden. They are tied unalterably to specific channels.

The following paragraph describes how the T/S 2000 handles these streams.

## 10.1 I/O Channel Tables

The T/S 2000 uses a number of tables located in the Home ROM and RAM. These tables contain initialization and other data for the "permanent" (dumb) devices (keyboard, screen, and printer) and initialization data for I/O streams.

SELTAB is a table containing offsets to the device dependent initialization routines for the channels 'K', 'S', and 'P'. The appropriate routine is invoked whenever a channel is selected (i.e., when a PRINT # is done). This table is illustrated by Figure 5.

|     |          |  |
|-----|----------|--|
| 'K' | SEL_K-\$ | SEL_K is the keyboard initialization routine |
| 'S' | SEL_S-\$ | SEL_S is the screen initialization routine   |
| 'P' | SEL_P-\$ | SEL_P is the printer initialization routine  |
| 0   |          |  |

Figure 5 . SELTAB TABLE

Any other dumb devices must also have entries in this table.

A new table (to reside in Home RAM) is needed to contain similar information for the intelligent devices. The data for this table is obtained from the Expansion Banks during initialization (refer to paragraph 11.2). This table is integrated into the SCT (System Configuration Table) and has the structure illustrated by Figure 6.

|               |
|---------------|
| 'device-spec' |
| bank no.      |
| init addrH    |
| init addrL    |
| •             |
| •             |
| •             |
| terminator    |

high order byte of init routine address  
low order byte of init routine address

Figure 6 . SELTAB INTELLIGENT DEVICE TABLE

This table must be searched whenever an intelligent device is selected.

SPEC\_T is a table containing offsets to the stream open routines for the channels 'K', 'S', and 'P'. The appropriate routine is invoked whenever a stream is opened using OPEN #. This table has the structure illustrated by Figure 7.

|     |           |  |
|-----|-----------|--|
| 'K' | open_K-\$ | OPEN_K is the keyboard stream open routine |
| 'S' | open_S-\$ | OPEN_S is the screen stream open routine   |
| 'P' | open_P-\$ | OPEN_P is the printer stream open routine  |
| 0   |           |  |

Figure 7 . SPEC\_T TABLE

Any other dumb devices must also have entries in this table.



A new table (to reside in Home RAM) is needed to contain similar information for the intelligent devices. The stream open data for this table is obtained from the Expansion Banks during initialization (refer to paragraph 11.2). This table is integrated into the SCT and has the structure illustrated by Figure 8.

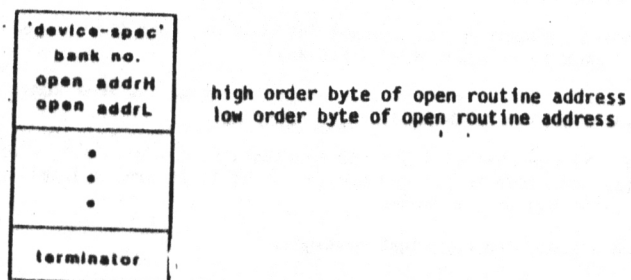


Figure 8 . SPEC\_T INTELLIGENT DEVICE TABLE

Whenever SPEC\_T is searched and a match is not found, the new table must also be searched.

CL\_TAB is a table containing offsets to the stream close routines for the channels 'K', 'S', and 'P'. The appropriate routine is invoked whenever a stream is closed using CLOSE #. This table has the structure illustrated by Figure 9.

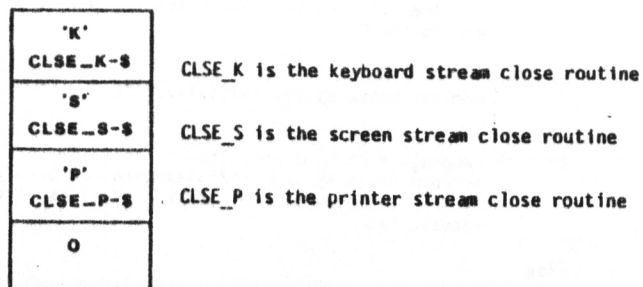


Figure 9 . CL\_TAB TABLE

Any other dumb devices must also have entries in this table.

A new table (to reside in Home RAM) is needed to contain similar information for the intelligent devices. The stream close data for this table is obtained from the Expansion Banks during initialization (refer to paragraph 11.2). This table is integrated into the SCT and has the structure illustrated by Figure 10.

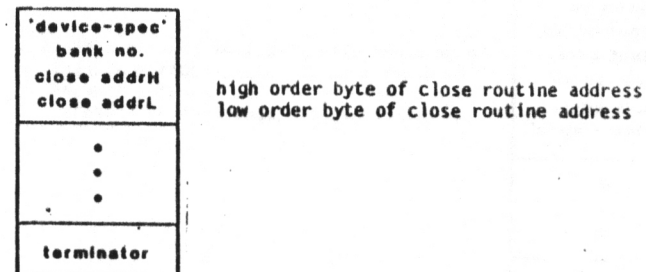


Figure 10 . CL\_TAB INTELLIGENT DEVICE TABLE

This table is searched whenever an intelligent device is closed.

CHINIT is a table containing I/O addresses for channels 'K', 'S', 'R', and 'P'. This table has the structure illustrated by Figure 11.

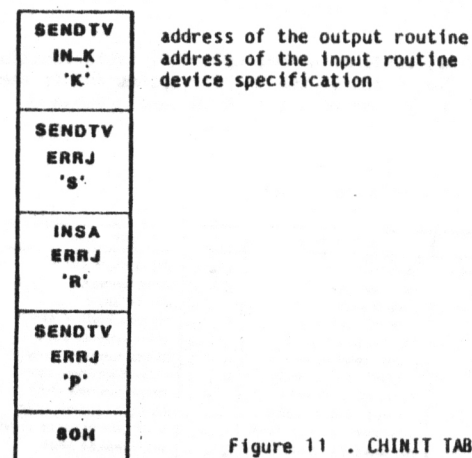


Figure 11 . CHINIT TABLE

Any other dumb devices must also have entries in this table. This information is loaded into Home RAM (at location CHANS) during system initialization (refer to paragraph 11.2).

15

A new table is needed to contain channel information for the intelligent devices. The channel data for this table is obtained from the Expansion Banks during initialization (refer to paragraph 11.4). This table is integrated into the SCT and has the structure illustrated by Figure 12.

|                 |
|-----------------|
| bank no.        |
| output addrH    |
| output addrL    |
| input addrH     |
| input addrL     |
| 'device - spec' |
| •               |
| •               |
| •               |
| terminator      |

high order byte of output routine address  
low order byte of output routine address  
high order byte of input routine address  
low order byte of input routine address

Figure 12 . CHINIT INTELLIGENT DEVICE TABLE

## 11. INITIALIZATION PROCEDURES

For operation of the T/S 2000 to commence, the system, Home Bank, DOCK Bank, and the peripheral expansion Banks must be initialized.

### 11.1 System Initialization

The System Configuration Table is built upon powerup. This table contains information describing the configuration of the TS 2000 system and is used by the initialization routines to determine what action to take. Table 4 lists the Configuration Table.

Table 4  
CONFIGURATION TABLE

| AROS           | LROS           | EXP. BANK 1           | • • • | EXP. BANK n           |
|----------------|----------------|-----------------------|-------|-----------------------|
| LANGUAGE TYPE  | CARTRIDGE TYPE | PRESNCE FLAG          | • • • | PRESNCE FLAG          |
| CARTRIDGE TYPE | START ADDR     | BANK NUMBER           | • • • | BANK NUMBER           |
| START ADDR     | CHUNK SELECT   | DEVICE SPEC           | • • • | DEVICE SPEC           |
| CHUNK SELECT   |                | (CHUNK SPEC IF RAM)   | • • • | (CHUNK SPEC IF RAM)   |
| AUTOSTART      |                | OPEN ROUTINE ADDR     | • • • | OPEN ROUTINE ADDR     |
| # BYTES OF VAR |                | CLOSE ROUTINE ADDR    | • • • | CLOSE ROUTINE ADDR    |
| SPACE          |                | SELECT ROUTINE ADDR   | • • • | SELECT ROUTINE ADDR   |
|                |                | INPUT ROUTINE ADDR    | • • • | INPUT ROUTINE ADDR    |
|                |                | OUTPUT ROUTINE ADDR   | • • • | OUTPUT ROUTINE ADDR   |
|                |                | DISK CHG HANDLER ADDR | • • • | DISK CHG HANDLER ADDR |
|                |                | INT HANDLER ADDR      | • • • | INT HANDLER ADDR      |
|                |                | INT ROUTINE ADDR      | • • • | INT ROUTINE ADDR      |
|                |                | RESET ROUTINE ADDR    | • • • | RESET ROUTINE ADDR    |
|                |                | DEVICE TYPE           | • • • | DEVICE TYPE           |
|                |                | DEVICE BOOT PRIORITY  | • • • | DEVICE BOOT PRIORITY  |
|                |                | DEVICE INT PRIORITY   | • • • | DEVICE INT PRIORITY   |

All fields, except for the presence flag, bank number and Chunk specification for RAM banks are read by the initialization routine from the bank in question. Note that only intelligent devices, and RAM banks appear in the System Configuration Table. Configuration information for dumb devices is stored in the channel I/O tables described in paragraph 10.1. The presence flag takes on the following values: 0 if nothing present; 1 if intelligent device is present; and 2 if RAM is present.

### 11.2. Home Bank Initialization

If there are neither AROS nor LROS attached to the system, the initialization of the Home Bank proceeds as it currently does in the Sinclair Spectrum, with the following exceptions:

After loading the permanent device channel information, load the channel information for each intelligent device (if any).

Load the bank selection code and function dispatcher from the Home ROM Extension to the Home RAM in Chunk 3.

Build (in Home RAM) new channel I/O table and the stream I/O select, open, and close tables (as described in paragraph 10.1). If there are no intelligent devices, then these tables are empty.

Display, on the screen, the copyright messages.

### 11.3. ROS Bank Initialization

The initialization procedure for the ROS Bank is as follows:

If LROS present Then  
If LROS present Then  
perform basic system initialization and pass control to the LROS boot address

Else  
If AROS present Then  
If AROS language = BASIC Then  
If to be autostarted Then  
Perform basic system initialization and  
Run the AROS

Else  
Perform basis system initialization

Else  
If AROS language = Machine code Then  
perform basic system initialization and pass control to the AROS boot address if it is to be autostarted.

Else  
Report Code - AROS contains code for a language without the proper LROS

Else  
No ROS present.

#### 11.4 Peripheral Expansion Banks Initialization

The initialization procedure for intelligent devices can be described as follows:

```

For each Expansion Bank Do:
  If not RAM Then
    read configuration information into the System Configuration
    Table.
    If the initialization type indicates that the device is to be
    initialized, call the initialization routine in the Expansion
    bank.
  Else
    Set the presence flag for RAM
    Set the Chunk spec
    Load interrupt handler into Chunk # at location 38H
  Endif
  Assign a bank number
Endfor
Boot the device with the highest bank priority.

```

#### 12. BANK SWITCHING COMMUNICATION ROUTINES

Communication between banks is accomplished by the transfer of control from one bank to another. Two layers of software are provided to programmers for this purpose. These layers are:

Indirect Communication  
Direct Communication

Services provided by these layers are described by giving a high level procedural interface and a description of the processing performed. These services are available to all banks. Also, advanced I/O features provided by high level languages are build on these software layers.

##### 12.1 Indirect Communication

The Indirect Communications layer consists of a set of assembly language routines which provide call/return and goto types of transfer of control and a routine for the transfer of data. For each of these routines there exists, in each bank other than the Home Bank, an interface routine. The interface routines mediate between the calling code and the code actually performing the service required in a transparent fashion. There is only one copy (in the Home ROM) of the actual service code for the Indirect Communications routines. These routines have the following syntax and semantics:

```

GOTO_BANK (addr, bank, horizontal-select)
  addr - The memory address to which control is to be
          transferred.
  bank - The number of the bank in which the memory address
          resides.
  horizontal-select - A bit pattern describing which Chunks are to
                     enabled (0 indicates enable, 1 indicates
                     disable).

```

This routine causes an unconditional transfer of control without return. The specified bank and the Chunk in which the specified memory address resides are selected.

```

CALL_BANK (addr, bank, horizontal-select, param-in, param-out)
  addr - the memory address to which control is to be
          transferred.
  bank - the number of the bank in which the memory address
          resides.
  horizontal-select - a bit pattern describing which Chunks are to
                     enabled (0 indicates enable, 1 indicates disable).
  param-in - number of bytes passed to called routine on the
              stack.
  param-out - number of bytes returned on the stack to the
              calling routine.

```

This routine causes an unconditional transfer of control with return. The specified bank and the Chunk in which the specified memory address resides are selected.

```

XFER_BYTES (src-addr, src-bank, dest-addr, dest-bank, length, direction)
  src-addr - the memory address from which the data is to be taken.
  src-bank - the number of the bank from which the data is to be taken.
  dest-addr - the memory address to which the data are to be transferred.
  length - the number of bytes to be transferred.
  direction - a flag indicating the direction of the transfer: -1 for
              high address to low or 1 for low address to high.

```

This routine causes the specified string of bytes to be moved to the specified location within the specified bank. The status of both the source and destination banks are left unchanged by this operation.

##### 12.2 Direct Communication

This layer of software provides a lower level of services to the systems programmer. The routines provided by this layer allow the selection status of any bank or Chunk to be read or modified. This layer provides the following routines:

```

BANK_ENABLE (bank, horizontal-select)
  bank - the number of the bank to be selected.
  horizontal-select - a bit pattern describing which Chunks are to
                     enabled (0 indicates enable, 1 indicates disable).

```

This routine allows the selection status of any bank or Chunk to be modified.

```

GET_BANK_STATUS (bank, status-ret, hor-sel-ret)
  bank - the number of the bank whose status is to be read.
  status-ret - where the status information is to be returned.
  hor-sel-ret - where the horizontal select value is to be returned.

```

This routine allows the status and horizontal select (which Chunks are selected) of any bank to be read from the bank selection hardware.

(cont'd. on page 23)



# TELECOMMUNICATION

Read the note in the next column.

We have run a few copies of the "Guide..." and they will be available at the next meeting. It is an excellent introduction to telecommunications with T/S machines, does everything claimed, and even has the main menu screens from several BBS's. This is a real time saver, if you study it before you log-on to a board. The book also contains, in one tome, most of the published "fixes" to the available modem software (e.g., patches for Byte Back, Tasman IF, etc.).

Steve and Pete asked for criticism, so here it is: We'd like to see some more hardware items. E.g., the 2050 schematic, Byte Backs, (if they'll let you), the "Zebra" RS 232 port, poor mans modem, and the techniques for defeating call waiting and direct connecting 2 modems without a phone line. Oh yes! and the mods for getting a 2050 working with IF one. Printer interfaces (e.g., printouts for Brother EP-44, 21 etc.) would also make a nice supplement.

Still, we repeat that this book is the best! It even has an infinite performance/price ratio.

NOTE: As of this writing the book is already complete and is available from Pete. There is a review of it in the Feb. '87 issue of COMPUTER SHOPPER. Judging it from the preliminary public domain version that Pete sent to LIST, we very highly recommend that you spend the five bucks and do yourself a favor.

In the January '87 issue of THE PLOTTER an article from RAMTOP was reprinted, which LIST readers might find of interest. The title of the article is Modem Fix (2050), and the author is Kurt A. Casby. The "fix" relates to the \$10-\$25 2050 Modem boards that many of LIST members bought and found that most of these were good boards, or had such a small problem that it could be fixed. The article is long, but let me quote a relevant portion:.

"I also found one good reason why my computer was crashing while dialing. This was due to the fact that a small resistor and capacitor that were in series with the reed relay were snipped and pulled up! I talked to a couple of guys that had bare board modems and found that their's had the same parts snipped. I resoldered them and that my computer no longer crashed. I also went a step further to rewire the ring detect so that it was isolated better. You can do this very easily. You only need buy a few cheap parts and find a spare 1/2 hour.

Here is how to do it. First disconnect the modem from the phone line, its 9 volt adapter, and the computer (with all power OFF). Now set the modem upside down on a sheet of foil (to prevent static discharge). Now you will have to remove 4 rubber feet and remove the 4 screws under the rubber feet. Now carefully remove the front and panels. The PC board will lift out. The resistor and capacitor that were snipped R-28 and C-22. I found that I was able to push both components back down and solder them. You may find that yours are just too short. If you need to replace them, get a 1/8 watt 100 Ohm resistor and a 470 pF capacitor rated 150 volts or better." Kurt then goes on to describe the ring detect circuit and the extra isolation that he mentioned. Read it in the LIST library.

HELLO FRIENDS IN THE LIST GROUP!

Well IT TOOK A BIT LONGER THAN EXPECTED, BUT HERE, AT LAST, IS OUR "GUIDE TO T/S TELECOMMUNICATIONS". AS PROMISED IN OUR FIRST LETTER, IT COVERS ALL THE T/S BULLETIN BOARDS, ALL THE MODEMS, ALL THE TERMINAL SOFTWARE AND MOST OF THE INTERFACES WE COULD FIND. IT COVERS DOWNLOADING IN GREAT DETAIL. THE BEST PART ABOUT IT IS THAT IT IS ENTIRELY IN THE PUBLIC DOMAIN AND MAY BE COPIED FREELY. WE REQUEST THAT YOU MAKE THIS COPY AVAILABLE TO YOUR MEMBERSHIP FOR REPRODUCTION. FOR THOSE MEMBERS WHO DON'T LIVE IN NEW YORK AND STILL WISH A COPY, THEY CAN GET ONE BY SENDING \$2<sup>00</sup> TO EITHER OF US (TO COVER COPIES & POSTAGE).

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- + SOME INFO ON INTERNATIONAL TELECOMMUNICATIONS
- + WHATEVER CORRECTIONS WE RECEIVE ON VERSION 1.0
- + ADDITIONAL INFORMATION AS YET UNSPECIFIED

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THANKS FOR YOUR HELP,  
SINCERELY

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*Pete Fischer*

## (Bankswitching, etc. From page 21)

GET\_BANK\_NUMBER (bank-no-ret, addr) 19  
bank-no-ret - where the bank number is to be returned.  
addr an address

This routine returns the number of the bank which currently owns the Chunk in which addr resides.

### 12.3 Restrictions

The above routines may be used as desired by programmers with the following restrictions:

Any service routine (i.e., CALL\_BANK) which manipulates Chunks (selecting and/or deselecting) must return the changed Chunk statuses to their original values.

Any code running in a Chunk which "shadows" a RAM Chunk in another bank must access data in that RAM Chunk via the indirect data transfer routine XFER BYTES (refer to paragraph 12.1).

Any bank wishing to enable a Chunk shadowed by Chunk 3 of the Home Bank should do the following: 1) Move the machine stack to the Chunk to be enabled (this implies the presence of RAM in this Chunk). If the value of the stack pointer is to be modified, its old value should be saved. 2) The bank selection code running in Chunk 3 of the Home Bank should be copied into the shadowed Chunk, at the same address at which it resides in the Home Bank. Otherwise, no bank will be able to access the bank selection software. 3) The stack must be restored to its original state when the shadowed Chunk is disabled and Chunk 3 in the Home Bank must be re-enabled. (If the second display file is in use, then the above applies to Chunk 7.)

You must never turn on two Chunks on the same horizontal level. The bank switching routines will always avoid this situation because when you request a given Chunk to be turned on, the bank switching routines will turn off that Chunk in any other bank in which it is selected.



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(To be cont'd.)

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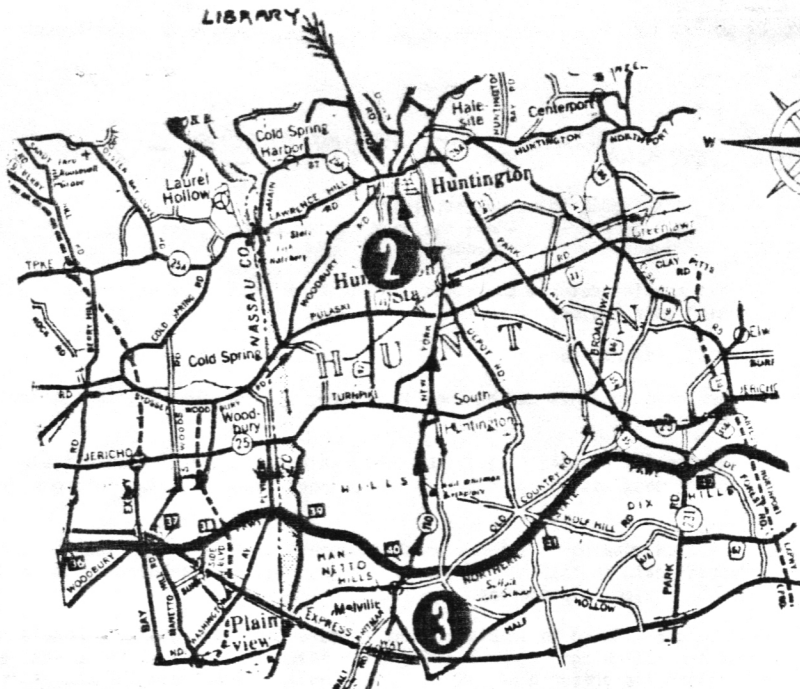
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# Long Island Sinclair-Timex Group



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